Department of Environmental Quality
Division of INL Oversight
and Radiation Control

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

July - September, 2004

State of Idaho
Division of INL Oversight and Radiation Control

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Table of Acronyms

ANL-W - Argonne National Laboratory West
BBWI - Bechtel BWXT Idaho, LLC
CERCLA - Comprehensive Environmental Response Compensation and Liability Act
CFA - Central Facilities Area
DEQ-INL - The State of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control
DOE - U.S. Department of Energy
EIC - electret ionization chamber
EML - Environmental Monitoring Laboratory
EPA - Environmental Protection Agency
ESER - Environmental Surveillance Education and Research Program (SM Stoller)
ESP - Environmental Surveillance Program
HPIC - high-pressure ion chamber
LLD - lower limit of detection
IBL - Idaho Bureau of Laboratories
INEEL - Idaho National Engineering & Environmental Laboratory
INTEC - Idaho Nuclear Technology and Engineering Center
LSC - liquid scintillation counting
µg/L - micrograms per liter
mg/L - milligrams per liter
mR/hr - milliRoentgen per hour
µR/hr - microRoentgen per hour
MCL - maximum contaminate level
MDA - minimum detectable activity
MDC - minimum detectable concentration
NIST - National Institute of Standards and Technology
nCi/L - nanocuries per liter
NOAA - National Oceanic and Atmospheric Administration
NRF - Naval Reactors Facility
pCi/L - picocuries per liter
pCi/m^3 - picocuries per cubic meter
PM_{10} - particulate matter with aero-dynamic diameter less than or equal to 10 micrometers
PCE - perchloroethene
QAPP - Quality Assurance Program Plan
QA/QC - Quality Assurance/Quality Control
RCRA - Resource Conservation and Recovery Act
RPD - relative percent difference
RWMC - Radioactive Waste Management Complex
SD - standard deviation
SMCL - secondary maximum contaminant level
TAN - Test Area North
TCE - trichloroethene
TDS - total dissolved solids
TMI - Three Mile Island
TSP - total suspended particulate
TSS - total suspended solids
USGS - U.S. Geological Survey
VOC - volatile organic compound
WLAP - Wastewater Land Application

Introduction

The state of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control (DEQ-INL) Environmental Surveillance Program (ESP) is conducted at locations on the INEEL, on the boundaries of the INEEL, and at distant locations to the INEEL in accordance with accepted monitoring procedures and management practices. This program is designed to provide the people of the state of Idaho with independently evaluated information about the impacts of the Department of Energy's (DOE) activities in Idaho.

The primary objective for DEQ-INL's ESP is to maintain an independent environmental monitoring and verification program designed to verify and supplement DOE's data and programs. This program is also used to provide the citizens of Idaho with information that has been independently evaluated to enable them to reach informed conclusions about DOE activities in Idaho and potential impacts to public health and the environment.

Results of the ESP are published using two distinct reporting formats: quarterly data reports and an annual ESP report. The annual ESP report is designed for a more broad audience and summarizes the results of the ESP for the previous four quarters. The annual report's primary emphasis is to focus on trends, ascertain the impacts of DOE operations on the environment, and confirm the validity of DOE monitoring programs. This quarterly report is designed to provide the mechanism to document the results of the ESP on a quarterly basis and provide detailed data to those who wish to "see the numbers." It is organized according to the media sampled and also provides a quality assurance assessment.

Air and Precipitation Monitoring Results

The ESP operated eight air monitoring stations on and near the INEEL as well as two monitoring stations distant from the INEEL during the third quarter, 2004 (**Figure 1**). These stations employed instrumentation for collecting airborne particulate matter (TSP and PM_{10}), gaseous radioiodine, precipitation, and water vapor for tritium analysis (**Table 1**). The Shoshone-Bannock Tribes operated an air monitoring station located at Fort Hall. The Fort Hall station uses identical instrumentation and sampling protocol as the ten stations operated by the ESP. The DEQ-INL reports the Fort Hall station data as an additional background site.

The high-volume total suspended particulate (TSP) air sampler is designated as the DEQ-INL's primary air sampler. There are currently two PM_{10} samplers collecting supplementary air data, along with radioiodine, at Mud Lake, and Atomic City. The Shoshone-Bannock Tribes discontinued the use of their PM_{10} sampler at the beginning of the second quarter of 2004.

Weekly gross alpha and gross beta radioactivity results for filters from the TSP samplers are presented in **Appendix A** and summarized in **Table 2**. Gross alpha and gross beta radioactivity concentrations reported from the particulate samples were within the range of expected values for naturally occurring radioactivity observed historically.

Weekly gross alpha and gross beta radioactivity results for the PM_{10} particulate air filters are presented in **Appendix B** and summarized in **Table 3**. Gross alpha and gross beta radioactivity concentrations reported from the particulate samples were within the range of expected values for naturally occurring radioactivity.

Composites of filters collected using TSP samplers and PM_{10} samplers during the course of a calendar quarter are analyzed using gamma spectroscopy. Typically, gamma spectroscopy results are only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC).

Gamma spectroscopy analysis results for the composites of TSP filters are presented in **Table 4** and gamma spectroscopy analysis results for the composites of PM_{10} filters are presented in **Table 5** for third quarter of 2004. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

No radioactive isotopes of iodine, specifically iodine-131, were detected on the weekly charcoal cartridges.

Atmospheric moisture samples were collected at eleven locations and analyzed for tritium. Atmospheric tritium concentrations were determined using the laboratory measured tritium concentration in the atmospheric moisture collected, the quantity of atmospheric moisture collected, and the volume of air sampled. Reported values are the result of either a single sample or a weighted mean when more than one atmospheric moisture sample was collected during the calendar quarter. Atmospheric tritium was detected at the Experimental Field Station and Van Buren Avenue during the third quarter of 2004. The detected tritium levels were less than 1 percent of the action levels established by DEQ-INL. The TMI-2 fuel currently stored at INTEC is the likely source for the atmospheric tritium observed. No atmospheric tritium was measured at offsite locations during the third quarter of 2004. Average atmospheric tritium concentrations are presented in **Table 6**.

Precipitation samples were collected at five monitoring locations during the third quarter of 2004. Precipitation sampling at Howe was discontinued during the third quarter of 2004, due to contamination of the precipitation from irrigation water. Precipitation samples are analyzed for tritium and gamma-emitting radionuclides. Tritium and gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the third quarter of 2004. Tritium and cesium-137 analysis results are presented in **Table 7**. Reported values are either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter.

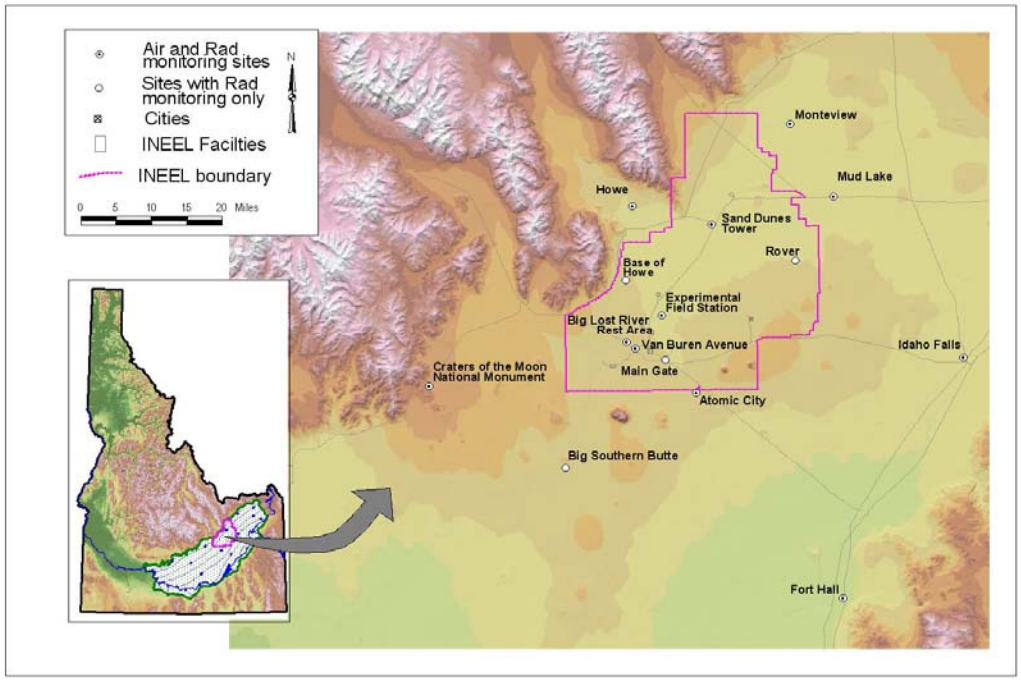

Figure 1. Air and radiation monitoring sites.

Table 1. Sampling locations and sample type.

Station Locations	Sample type[1]				
	PM_{10}	TSP	Radioiodine	Water Vapor	Precipitation
Onsite Locations					
Big Lost River Rest Area		☐	☐	■	■
Experimental Field Station		☐	☐	■	
Sand Dunes Tower		☐	☐	■	
Van Buren Avenue		☐	☐	■	
Boundary Locations					
Atomic City	☐	☐	☐	■	■
Howe		☐	☐	■	■
Monteview		☐	☐	■	■
Mud Lake	☐	☐	☐	■	■
Distant Locations					
Craters of the Moon		☐	☐	■	
Fort Hall[2]		☐	☐	■	
Idaho Falls		☐	☐	■	■

[1] ☐ Samples collected weekly; ■ Samples collected quarterly.
[2] Operated by Shoshone-Bannock Tribes.

Table 2. Range of alpha and beta concentrations for TSP filters, third quarter, 2004. Concentrations are reported in 1x 10^{-3} pCi/m^3.

Station Location	Concentration	
	Gross Alpha	Gross Beta
Onsite Locations		
Big Lost River Rest Area	0.5 - 1.4	16.9 - 32.4
Experimental Field Station	0.6 - 1.3	17.2 - 32.0
Sand Dunes Tower	0.5 - 1.0	13.8 - 28.8
Van Buren Avenue	0.7 - 1.5	18.8 - 37.9
Boundary Locations		
Atomic City	0.9 - 1.5	19.5 - 35.1
Howe	0.4 - 1.0	15.3 - 28.0
Monteview	0.5 - 1.3	10.7 - 24.2
Mud Lake	0.5 - 1.6	14.6 - 25.8
Distant Locations		
Craters of the Moon	0.4 - 1.1	14.2 - 28.2
Fort Hall[1]	0.6 - 1.7	13.0 - 24.6
Idaho Falls	0.6 - 1.4	15.4 - 27.6

[1] Operated by Shoshone-Bannock Tribes.

Table 3. Range of alpha and beta concentrations for PM_{10} filters, third quarter, 2004. Concentrations are reported in 1x 10^{-3} pCi/m^3.

Station Location	Concentration	
	Gross Alpha	Gross Beta
Boundary Locations		
Atomic City	0.7 - 1.6	21.9 - 52.5
Mud Lake	0.6 - 1.6	19.7 - 43.9

Table 4. Gamma spectroscopy analysis data of TSP filters, composite sample, third quarter, 2004. Concentrations are reported in 1 x 10^{-3} pCi/m^3 with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the quarter.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
Onsite Locations			
Big Lost River Rest Area	100	5	<MDC
Experimental Field Station	94	5	<MDC
Sand Dunes Tower	94	5	<MDC
Van Buren Avenue	113	6	<MDC
Boundary Locations			
Atomic City	105	6	<MDC
Howe	100	5	<MDC
Monteview	78	4	<MDC
Mud Lake	85	5	<MDC
Distant Locations			
Craters of the Moon	105	6	<MDC
Fort Hall[1]	96	5	<MDC
Idaho Falls	89	5	<MDC

[1] Operated by Shoshone-Bannock Tribes.

Table 5. Gamma spectroscopy analysis data of PM_{10} filters, composite sample, third quarter, 2004. Concentrations are reported in 1 x 10^{-3} pCi/m^3 with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the quarter.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
Boundary Locations			
Atomic City	123	7	<MDC
Mud Lake	116	7	<MDC

Table 6. Tritium concentrations from atmospheric moisture, third quarter, 2004. Concentrations are reported in pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium		
	Concentration	± 2 SD	MDC
Onsite Locations			
Big Lost River Rest Area	0.54[1]	0.24	0.37
Experimental Field Station	0.29	0.21	0.32
Sand Dunes Tower	0.15	0.23	0.37
Van Buren Avenue	0.46[1]	0.23	0.35
Boundary Locations			
Atomic City	0.13	0.20	0.34
Howe	0.11	0.23	0.39
Mud Lake	0.06	0.26	0.43
Monteview	0.13	0.21	0.36
Distant Locations			
Craters of the Moon	0.09	0.21	0.35
Fort Hall	0.14	0.24	0.39
Idaho Falls	0.14	0.20	0.33

[1] The reported concentrations exceeds the MDC.

Table 7. Tritium and cesium-137 concentrations from precipitation, third quarter, 2004. Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
Onsite Locations						
Big Lost River Rest Area	70	80	130	-0.9	1.6	2.8
Boundary Locations						
Atomic City	40	80	130	-0.1	1.9	3.2
Howe[1]						
Monteview	-40	70	130	-0.2	1.4	2.5
Mud Lake	30	80	130	0.5	1.4	2.4
Distant Locations						
Idaho Falls	-20	70	130	-0.1	1.5	2.6

[1] Precipitation sampling was discontinued during the sampling period due to contamination caused from irrigation water

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the third quarter of 2004 **(Figure 1)**. Each of these stations is instrumented with an electret ionization chamber (EIC), and 11 of the stations also have high-pressure ion chambers (HPIC) **(Table 8)**. The Shoshone-Bannock Tribes operate an additional environmental radiation station at Fort Hall. The DEQ-INL reports these results.

HPICs are instruments capable of real-time measurements, and therefore can detect small changes in gamma radiation levels over time. Since HPICs offer real-time gamma radiation measurement and data acquisition, DEQ-INL collects this information electronically and provides graphed data via the world wide web at www.idahoop.org. EICs are a passive integrating system that provides a cumulative measure of environmental gamma radiation exposure. DEQ-INL compared the exposure rates measured by EICs and HPICs and observed that the data correlated very well from both measurement methods; although, EICs tend to over respond by approximately 20 percent, accounting for the slight differences observed between the two measurements. A complete analysis of the radiation measuring devices can be found in *A Comparison of Three Methods for Measuring Environmental Radiation*, Moser, Kristi, Idaho State University, M.S.Thesis, 2002. Each system is used by DEQ-INL to measure gamma radiation for various radiological monitoring objectives. EICs offer an inexpensive methodology to measure gamma radiation over a wide area, particularly in regions which do not have a power source. EICs can also provide valuable gamma radiation data in the event of an emergency. It is because of this reason that EICs are also deployed at 78 locations by DEQ-INL in a widespread network around the INEEL measuring general background radiation. This information is tabulated in **Appendix C.**

Table 9 lists the average radiation exposure rates measured by the HPICs for the quarter. Exposure rates were within the expected range of values for historical background radiation. **Table 10** lists the EIC monitoring results for third quarter, 2004.

Table 8. Summary of instrumentation at radiation monitoring stations.

Station Location	Instrument Type	
	HPIC	EIC
Onsite Locations		
Base of Howe	■	■
Big Lost River Rest Area	■	■
Experimental Field Station		■
Main Gate	■	■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
Boundary Locations		
Atomic City	■	■
Big Southern Butte	■	■
Howe	■	■
Monteview	■	■
Mud Lake	■	■
Distant Locations		
Craters of the Moon		■
Fort Hall[1]	■	■
Idaho Falls	■	■

[1] HPIC operated by Shoshone-Bannock Tribes with the EIC maintained by DEQ-INL.

Table 9. Average gamma exposure rates for third quarter 2004, from HPIC network. These rates are expressed in µR/hr.

Station Location	Exposure Rate	
	Quarterly Average	± 2 SD
Onsite Locations		
Base of Howe	12.5	1.0
Big Lost River Rest Area	15.3	1.8
Main Gate	14.3	0.8
Rover	14.2	0.5
Sand Dunes Tower	14.1	0.8
Boundary Locations		
Atomic City	13.2	0.8
Big Southern Butte	13.4	4.2
Howe	12.6	0.8
Monteview	12.2	0.6
Mud Lake	12.7	0.5
Distant Locations		
Fort Hall[1]	12.1	0.5
Idaho Falls	11.9	0.6

[1] Operated by Shoshone-Bannock Tribes.

Table 10. Electret Ionization chamber (EIC) cumulative average exposure rates for third quarter, 2004. These rates are expressed in µR/hr.

Station Location	Exposure Rate	
	Total	± 2 SD
Onsite Locations		
Base of Howe	17.6	1.9
Big Lost River Rest Area	20.7	2.0
Experimental Field Station	21.5	2.0
Main Gate	21.9	2.0
Rover	19.1	2.0
Sand Dunes Tower	17.6	1.9
Van Buren Avenue	23.4	2.1
Boundary Locations		
Atomic City	18.8	2.4
Big Southern Butte	17.4	1.9
Howe	16.2	1.9
Monteview	18.5	1.9
Mud Lake	18.5	2.4
Distant Locations		
Craters of the Moon	17.1	2.0
Fort Hall	20.3	2.0
Idaho Falls	15.5	1.8

Water Monitoring & Verification Results

Water Monitoring

Water monitoring sites are sampled for the primary purpose of examining trends of key INEEL contaminants and other general groundwater quality indicators. These sites are divided into groupings consisting of sites located on the INEEL or its boundary, and those off or distant from the INEEL. Sites are typically co-sampled with the USGS or DOE's environmental monitoring contractor. Sixteen water monitoring locations were sampled during the third quarter of 2004, two locations on or bounding the INEEL and 14 locations offsite or distant from the INEEL (**Figure 2**).

Gross alpha radioactivity was detected in three samples from distant locations ranging from 3.4 ± 2.0 to 4.0 ± 2.1 pCi/L. Gross beta radioactivity was detected in all of the samples except for a sample collected at a distant location. Detectable gross beta activity ranged from 2.1 ± 1.0 to 2.4 ± 1.0 pCi/L for onsite and 2.5 ± 1.0 to 10.1 ± 1.1 for offsite and distant locations. The concentrations of gross alpha and gross beta activity were consistent with historical results and were within expected ranges. No man-made gamma-emitting radionuclides were identified via gamma spectroscopic analysis. Results for gross alpha, gross beta, and man-made gamma emitting radioactivity are shown in **Table 11.**

Gross beta analyses are also conducted as a screening tool for beta emitting radionuclides potentially released due to INEEL operations. In the event of known high or unexpected levels of gross beta radioactivity, samples may also be analyzed for technetium-99 and strontium-90. No samples were collected for these radionuclides this quarter.

Tritium was not detected in boundary, distant, or offsite samples using the standard analytical method for this isotope (**Table 12)**. Water samples with tritium concentrations not measurable using the standard analytical method (MDC of 160 pCi/L) are analyzed using an electrolytic enrichment method with a much lower MDC of 10 to 14 pCi/L. The analytical results for these samples are presented in **Table 13**. Tritium was not detected in samples from boundary locations using the enrichment method, but samples from eight of the distant locations had concentrations ranging from 10 ± 5 pCi/L to 36 ± 7 pCi/L. All samples were consistent with typical tritium background levels of 0 to 40 pCi/L, significantly below the EPA drinking water standard of 20,000 pCi/L.

Water samples were also analyzed for metals and the results are shown in **Table 14**. Barium concentrations ranged from 12 to 102 µg/L and were less than the maximum contaminant level (MCL) of 2,000 µg/L established by the EPA for drinking water. A sample collected from the Mud Lake Water Supply contained 40 µg/L manganese. Background concentrations for manganese are typically less than 5 µg/L at this location. The recommended EPA drinking water secondary maximum contaminant level (SMCL) for manganese is 50 µg/L. Zinc was also detected at five locations and ranged from 7 to 60 µg/L, all less than the SMCL of 5,000 µg/L.

Common ion and nutrient results are shown in **Table 15.** Two samples collected from offsite locations, MV-05 and MV-53, had nitrate concentrations of 2.18 and 4.19 mg/L, respectively. Typical background nitrate concentrations observed by DEQ-INL are less than 2 mg/L; however, these results are significantly below the nitrate MCL of 10 mg/L. In addition, samples from the same two locations had elevated sulfate concentrations (66.1 mg/L and 77.3 mg/L), although less than the SMCL of 250 mg/L. The elevated concentrations of these two compounds indicate that man-made activities downgradient of the INEEL are the most likely the source.

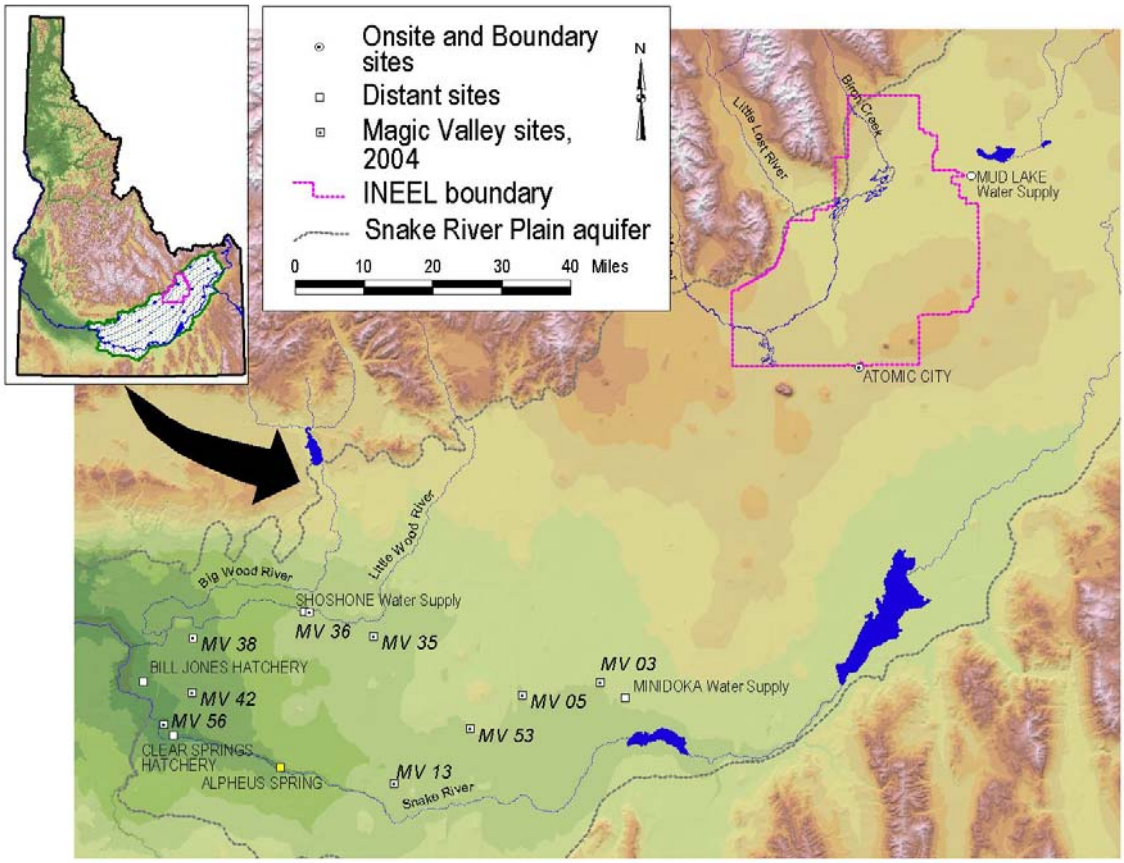

Figure 2. Water monitoring locations.

Table 11. Alpha, beta, and gamma concentrations[1] for water monitoring samples, third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Gross Alpha		Gross Beta		Man-made gamma-emitting radionuclide Cesium-137
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration
Onsite and Boundary						
Atomic City	8/17/2004	1.0 U	1.9	2.4	1.0	<MDC
Mud Lake Water Supply	8/17/2004	-1.1 U	1.1	2.1	1.0	<MDC
Offsite and Distant						
Alpheus Spring	8/10/2004	0.6 U	2.3	5.0	1.1	<MDC
Bill Jones Hatchery	7/26/2004	2.9 U	2.0	4.1	1.0	<MDC
Clear Spring	8/10/2004	-1.9 U	2.3	2.7	1.0	<MDC
Minidoka Water Supply	8/10/2004	-0.1 U	1.9	2.5	1.0	<MDC
Shoshone Water Supply	8/10/2004	1.0 U	1.9	3.3	1.0	<MDC
MV-03	7/27/2004	4.0	2.1	3.6	1.0	<MDC
MV-05	7/27/2004	2.8 U	2.6	8.9	1.2	<MDC
MV-13	8/10/2004	3.9 U	3.0	9.0	1.2	<MDC
MV-35	7/27/2004	3.9	1.8	10.1	1.1	<MDC
MV-36	7/28/2004	2.8 U	2.1	4.6	1.0	<MDC
MV-38	7/26/2004	3.4	2.0	4.9	1.0	<MDC
MV-42	7/26/2004	3.3 U	2.4	0.9 U	1.1	<MDC
MV-53	7/27/2004	0.9 U	2.8	5.2	1.2	<MDC
MV-56	7/26/2004	2.3 U	2.3	2.2	1.0	<MDC

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. <MDC – Less than minimum detectable concentration for analysis by gamma spectroscopy.

Table 12. Tritium concentrations[1] for water monitoring samples, third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Tritium		
		Concentration		± 2 SD
Onsite and Boundary				
Atomic City	8/17/2004	-20	U	70
Mud Lake Water Supply	8/17/2004	-20	U	70
Offsite and Distant				
Alpheus Spring	8/10/2004	10	U	70
Bill Jones Hatchery	7/26/2004	0	U	60
Clear Spring	8/10/2004	30	U	70
Minidoka Water Supply	8/10/2004	-30	U	70
Shoshone Water Supply	8/10/2004	0	U	70
MV-03	7/27/2004	60	U	60
MV-05	7/27/2004	40	U	60
MV-13	8/10/2004	20	U	70
MV-35	7/27/2004	0	U	60
MV-36	7/28/2004	60	U	70
MV-38	7/26/2004	10	U	60
MV-42	7/26/2004	20	U	60
MV-53	7/27/2004	40	U	60
MV-56	7/26/2004	20	U	60

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 13. Enriched tritium concentrations[1] for water monitoring samples, third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Tritium		
		Concentration		± 2 SD
Onsite and Boundary				
Atomic City	8/17/2004	7	U	5
Mud Lake Water Supply	8/17/2004	3	U	5
Offsite and Distant				
Alpheus Spring	8/10/2004	28		6
Bill Jones Hatchery	7/26/2004	6	U	5
Clear Spring	8/10/2004	12		5
Minidoka Water Supply	8/10/2004	10		5
Shoshone Water Supply	8/10/2004	22		6
MV-03	7/27/2004	-2	U	5
MV-05	7/27/2004	5	U	6
MV-13	8/10/2004	36		7
MV-35	7/27/2004	3	U	6
MV-36	7/28/2004	25		7
MV-38	7/26/2004	23		6
MV-42	7/26/2004	7	U	6
MV-53	7/27/2004	30		6
MV-56	7/26/2004	4	U	6

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 14. Dissolved trace metal concentrations[1] of filtered water monitoring samples, third quarter, 2004. Concentrations are expressed in µg/L.

Sample Location	Sample Date	Concentration				
		Barium	Chromium	Manganese	Lead	Zinc
Onsite and Boundary						
Atomic City	8/17/2004	33	<5 U	<2 U	<5 U	12
Mud Lake Water Supply	8/17/2004	19	<5 U	40	<5 U	<5 U
Offsite and Distant						
Alpheus Spring	8/10/2004	79	<5 U	<2 U	<5 U	<5 U
Bill Jones Hatchery	7/26/2004	20	<5 U	<2 U	<5 U	<5 U
Clear Spring	8/10/2004	35	<5 U	<2 U	<5 U	<5 U
Minidoka Water Supply	8/10/2004	35	<5 U	<2 U	<5 U	7
Shoshone Water Supply	8/10/2004	39	<5 U	<2 U	<5 U	7
MV-03	7/27/2004	22	<5 U	<2 U	<5 U	<5 U
MV-05	7/27/2004	51	<5 U	<2 U	<5 U	<5 U
MV-13	8/10/2004	88	<5 U	<2 U	<5 U	<5 U
MV-35	7/27/2004	12	<5 U	<2 U	<5 U	<5 U
MV-36	7/28/2004	40	<5 U	<2 U	<5 U	6
MV-38	7/26/2004	29	<5 U	<2 U	<5 U	<5 U
MV-42	7/26/2004	23	<5 U	<2 U	<5 U	14
MV-53	7/27/2004	102	<5 U	<2 U	<5 U	60
MV-56	7/26/2004	24	<5 U	<2 U	<5 U	<5 U

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.

Table 15. Common ions and nutrient concentrations[1] for water monitoring samples, third quarter, 2004. Concentrations are expressed in mg/L.

Sample Location	Sample Date	Concentration					
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride
Onsite and Boundary							
Atomic City	8/17/2004	36.0	13.9	17	3.3	0.71	17.7
Mud Lake Water Supply	8/17/2004	9.2	2.9	31	4.9	0.75	5.6
Offsite and Distant							
Alpheus Spring	8/10/2004	58.0	20.6	36	6.5	0.54	42.9
Bill Jones Hatchery	7/26/2004	32.0	16.3	16	3.5	0.60	11.0
Clear Spring	8/10/2004	47.0	19.9	25	4.1	0.68	35.0
Minidoka Water Supply	8/10/2004	47.0	16.6	21	3.4	0.75	33.0
Shoshone Water Supply	8/10/2004	42.0	14.7	14	3.0	0.41	6.2
MV-03	7/27/2004	38.0	15.6	23	3.5	0.85	26.8
MV-05	7/27/2004	53.0	23.3	44	5.3	0.69	54.9
MV-13	8/10/2004	55.0	20.4	39	6.5	0.56	38.8
MV-35	7/27/2004	26.0	13.4	12	3.0	0.62	8.1
MV-36	7/28/2004	47.0	15.4	14	2.9	0.30	6.6
MV-38	7/26/2004	40.0	14.2	14	2.9	0.48	8.7
MV-42	7/26/2004	38.0	19.4	20	2.9	0.63	15.9
MV-53	7/27/2004	71.0	29.3	58	7.1	0.60	72.6

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration;
[2] As $CaCo_3$
[3] Dissolved nitrate + nitrite as N
[4] Dissolved phosphorus as P

Table 15 continued. Common ions and nutrient concentrations[1] for water monitoring samples, third quarter, 2004. Concentrations are expressed in mg/L.

Sample Location	Sample Date	Concentration				
		Sulfate	Silica	Total Alkalinity[2]	Total Nitrate + Nitrite[3]	Total Phosphorus[4]
Onsite and Boundary						
Atomic City	8/17/2004	16.6	NS	135	1.39	0.015
Mud Lake Water Supply	8/17/2004	7.9	NS	93	<0.005 U	0.032
Offsite and Distant						
Alpheus Spring	8/10/2004	56.8	NS	183	1.98	0.014
Bill Jones Hatchery	7/26/2004	23.7	31.9	138	0.97	0.016
Clear Spring	8/10/2004	46.7	NS	148	1.47	0.014
Minidoka Water Supply	8/10/2004	40.2	NS	137	1.02	0.011
Shoshone Water Supply	8/10/2004	15.5	NS	166	1.16	0.022
MV-03	7/27/2004	34.0	30.9	133	1.37	0.015
MV-05	7/27/2004	66.1	32.3	172	2.18	0.018
MV-13	8/10/2004	57.6	41.7	193	1.74	0.017
MV-35	7/27/2004	18.6	31.1	115	0.55	0.016
MV-36	7/28/2004	16.8	28.8	172	1.37	0.033
MV-38	7/26/2004	18.4	29.6	149	1.18	0.029
MV-42	7/26/2004	31.5	33.6	152	1.40	0.028
MV-53	7/27/2004	77.3	34.9	215	4.19	0.021

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration;
[2] As $CaCo_3$
[3] Dissolved nitrate + nitrite as N
[4] Dissolved phosphorus as P

Water Verification Sampling Program

Water samples were collected from selected sites to verify results attained by various DOE monitoring programs (**Figure 3**). The primary drivers for the DOE monitoring conducted at each facility are divided into three basic groups: DOE monitoring conducted to support remediation activities (CERCLA), water monitoring to support wastewater land application permits (WLAP), and monitoring conducted under DOE environmental directives (surveillance). Selected sites monitored by BBWI, NRF and ANL-W are sampled each year and a comparison of results is presented in the DEQ-INL annual report. During the third quarter of 2004, the DEQ-INL sampled 11 groundwater and 2 wastewater sites.

Gross alpha radioactivity was detected in samples collected from three of the seven groundwater sites. All three sites are in an area of known contamination near the injection wells at Test Area North (TAN). The levels of alpha radioactivity ranged from 11.4 ± 5.1 to 37.2 ± 7.6 pCi/L. The highest concentration, at TAN-37, exceeded the MCL of 15 pCi/L, a value that is consistent with historical trends. Gross beta radioactivity was measured in each sample ranging from 2.0 ± 0.8 to 1,185.7 ± 12.6 pCi/L from locations of known INEEL contamination. The highest concentration was found at TAN-37. No man-made gamma-emitting radionuclides were detected this quarter. Analytical results for gross alpha, gross beta, and gamma radioactivity are presented in **Table 16.**

Strontium-90 was detected in TAN wells 28, 29, and 37 at concentrations greater than the 8 pCi/L MCL ranging from 44 ± 10 to 550 ± 130 pCi/L (**Table 17**). Each well is downgradient of the TAN injection wells, an area of known contamination, and the concentrations are consistent with historical trends.

Tritium was detected in 6 of 11 samples ranging from 130 ± 80 to 4,810 ± 190 pCi/L (**Table 18**). The highest concentration was found at TAN-28, an area of known contamination near the TAN injection wells. All concentrations were below the EPA drinking water standard of 20,000 pCi/L.

Common ion results are shown in **Table 19**. The highest concentrations for common ions were found from wastewater samples collected from the NRF Sewage Lagoon and from the NRF Industrial Waste Ditch during the third quarter of 2004. Total alkalinity, TDS, and chloride were high at NRF likely due to discharges to the lagoon and ditch from the NRF water softening system and a reverse osmosis water treatment system in use at the facility.

Total alkalinity measured in groundwater at NRF ranged from 171 to 199 mg/L (background concentrations range from 106 to 276 mg/L). Chloride concentrations found in NRF groundwater samples ranged from 39 to 453 mg/L (SMCL of 250 mg/L). Sulfate concentrations in groundwater at NRF ranged from 38.4 to 96.8 mg/L which exceed typical background concentrations of 10 to 40 mg/L, but below the SMCL of 250 mg/L. Total dissolved solids in groundwater at NRF ranged from 360 to 1,400 mg/L with one sample exceeding the recommended EPA SMCL of 500 mg/L. These elevated parameters found in the groundwater at NRF are more than likely caused by the discharges of the aforementioned water processing systems.

All measured nutrient concentrations at each monitoring site were within expected ranges (**Table 20**). Results for metal analyses are shown in **Table 21.** Elevated concentrations of calcium, sodium, and barium in samples collected from the NRF Industrial Waste Ditch and Sewage Lagoon were also likely a result of discharges from the water softening system and a reverse osmosis water treatment system at NRF. Iron concentrations in samples collected from the NRF Sewage Lagoon were elevated (810 µg/L) but consistent with historical results.

Seven samples from 11 locations had detectable concentrations of volatile organic compounds (VOCs) consistent with historical results. The analytical results for VOCs are shown in **Table 22.** Those samples with detectable VOCs were collected from locations downgradient of the TAN injection wells where a trichloroethylene (TCE) contaminant plume, approximately two miles long has been identified. The TCE plume is currently undergoing remediation by the DOE.

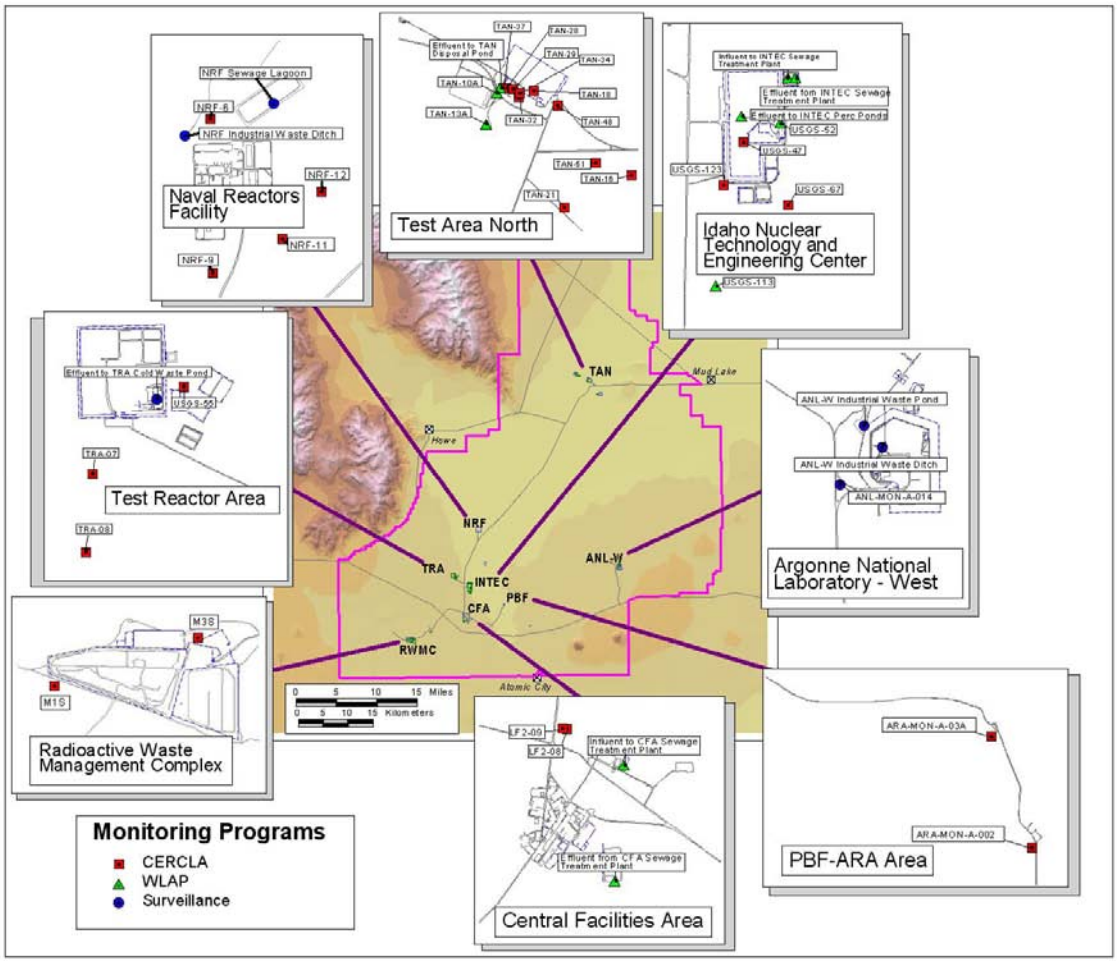

Figure 3. Planned water verification sampling sites for 2004. The purpose of DOE monitoring for each site is indicated in the figure key.

Table 16. Gross alpha, gross beta, and cesium-137 concentrations[1] in unfiltered water samples collected for verification purposes during the third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Gross Alpha		Gross Beta		Man-made, gamma-emitting radionuclide Cesium-137	
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration	± 2 SD
Groundwater							
NRF-6	7/19/2004	13.1 U	8.4	9.8	3.0	0.7 U	1.4
NRF-9	7/19/2004	-2.1 U	3.0	2.1	1.1	0.6 U	1.0
NRF-11	7/20/2004	3.2 U	3.3	2.3	1.1	-1.5 U	1.4
NRF-12	7/20/2004	1.2 U	3.1	2.0	1.1	0.5 U	1.4
TAN-28	8/24/2004	9.6 J	3.8	297.3 J	4.6	0.9 U	1.0
TAN-29	8/24/2004	11.4	5.1	313.0	6.6	-0.1 U	1.4
TAN-37	8/24/2004	37.2	7.6	1185.7	13.0	2.9 U	1.4

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.
[2] Data reflects the average of an actual sample result and the result of a corresponding laboratory split, recount, re-distillation, or re-evaporation.

Table 17. Strontium-90 concentrations[1] in unfiltered water samples collected for verification purposes during the third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Strontium-90	
		Concentration	± 2 SD
Groundwater			
NRF-6	7/19/2004	0.01 U	0.2
NRF-9	7/19/2004	0.23 U	0.3
NRF-11	7/20/2004	0.09 U	0.3
NRF-12	7/20/2004	0.05 U	0.3
TAN-28	8/24/2004	261.00	6.0
TAN-29	8/24/2004	44.00	10.0
TAN-37	8/24/2004	550.00	130.0

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 18. Tritium concentrations[1] in unfiltered water samples collected for verification purposes during the third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
Groundwater			
NRF-6	7/19/2004	100 U	70
NRF-9	7/19/2004	100 U	70
NRF-11	7/20/2004	130	80
NRF-12[2]	7/20/2004	40 U	49
ANP-8	8/25/2004	40 U	70
TAN-16	8/11/2004	220	80
TAN-28	8/24/2004	4810	190
TAN-29	8/24/2004	2870	150
TAN-37	8/24/2004	1860	130
TAN-51	8/11/2004	1050	110
TAN-57[2]	8/23/2004	5 U	49

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected.
[2] Data reflects the average of an actual sample result and the result of a corresponding laboratory split, recount, re-distillation, or re-evaporation.

Table 19. Common ion concentrations[1] of unfiltered water samples collected for verification purposes during the third quarter, 2004. Concentrations are expressed in mg/L.

Sample Location	Sample Date	Concentration						
		Total Alkalinity	Chloride	Fluoride	Silica	Sulfate	TDS[2]	TSS[3]
Wastewater								
NRF Sewage Lagoon (total)	9/21/2004	622	217	0.76	45.1	111.0	1300	150
NRF Ind. Waste Ditch (total)	9/21/2004	143	20930	<0.10 U	9.0	<2.0 U	37000	6
Groundwater								
NRF-6 (dissolved)	7/19/2004	171	453	0.22	23.4	96.8	1400	<1 U
NRF-9 (dissolved)	7/19/2004	<1 R	42	0.21	22.6	39.1	360	<1 U
NRF-11 (dissolved)	7/20/2004	199	41	0.3	22.9	38.8	360	<1 U
NRF-12 (dissolved)	7/20/2004	198	39	0.3	21.6	38.4	360	<1 U

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.
[2] Total dissolved solids.
[3] Total suspended solids.

Table 20. Total nutrient concentrations[1] of unfiltered water samples collected for verification purposes during the third quarter, 2004. Concentrations are expressed in mg/L.

Sample Location	Sample Date	Concentration				
		Nitrite + Nitrate (as nitrogen)	Phosphorus	Total Kjeldahl Nitrogen	Ammonia	Nitrite as Nitrogen
Wastewater						
NRF Sewage Lagoon (total)	9/21/2004	<0.005 U	5.520	25.00	NR	0.012
NRF Ind. Waste Ditch (total)	9/21/2004	0.09	1.280	<0.05 U	NR	0.006
Groundwater						
NRF-6 (total)	7/19/2004	2.03	0.078	0.14	NR	<0.005 U
NRF-9 (total)	7/19/2004	2.15	0.032	0.09	NR	
NRF-11 (total)	7/20/2004	1.86	0.032	0.10	NR	<0.005 U
NRF-12 (total)	7/20/2004	1.83	0.032	<0.05 U	NR	<0.005 U

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration; NR = analysis not requested.

Table 21. Metal concentrations[1] of water samples collected for verification purposes during the third quarter, 2004. Samples were not filtered, unless otherwise noted.

Sample Location	Sample Date	Concentration											
		Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)
Wastewater													
NRF Sewage Lagoon (total)	9/21/2004	25	6.2	420	28.0	8	50	<1 U	<1 U	<5 U	<10 U	10	810
NRF Ind. Waste Ditch (total)	9/21/2004	818	248	12800	37.0	<25 U	1700	<2 U	<2 U	<100 U	<100 U	<100 U	200
Groundwater													
NRF-6 (total)	7/19/2004	159	40	175	5.9	<5 U	142	<1 U	<1 U	25	<10 U	<10 U	60
NRF-9 (total)	7/19/2004	76	23	18	2.9	<5 U	141	<1 U	<1 U	8	<10 U	<10 U	70
NRF-11 (total)	7/20/2004	72	22	20	2.7	<5 U	148	<1 U	<1 U	17	<10 U	<10 U	80
NRF-12 (total)	7/20/2004	72	22	19	2.6	<5 U	146	<1 U	<1 U	16	<10 U	<10 U	60

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration; NR = analysis not requested.

Table 21 continued. Metal concentrations[1] of water samples collected for verification purposes during the third quarter, 2004. Samples were not filtered, unless otherwise noted.

Sample Location	Sample Date 2004	Concentration										
		Lead (µg/L)	Manganese (µg/L)	Thallium (µg/L)	Nickel (µg/L)	Silver (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Antimony (µg/L)	Aluminum (µg/L)	Selenium (µg/L)	Mercury (µg/L)
Wastewater												
NRF Sewage Lagoon (total)	9/21/2004	<5 U	31	<1.5 U	<10 U	<5 U	NR	60	10	230	<10 U	<0.5 U
NRF Ind. Waste Ditch (total)	9/21/2004	<10 U	150	<10 U	<50 U	<10 U	NR	<50 U	<10 U	<500 U	<50 U	<0.5 U
Groundwater												
NRF-6 (total)	7/19/2004	<5 U	<2 U	<1.5 U	<10 U	<1 U	NR	<5 U	<5 U	<100 U	<10 U	<0.5 U
NRF-9 (total)	7/19/2004	<5 U	<2 U	<1.5 U	<10 U	<1 U	NR	<5 U	<5 U	<100 U	<10 U	<0.5 U
NRF-11 (total)	7/20/2004	<5 U	<2 U	<1.5 U	<10 U	<1 U	NR	<5 U	<5 U	<100 U	<10 U	<0.5 U
NRF-12 (total)	7/20/2004	<5 U	<2 U	<1.5 U	<10 U	<1 U	NR	<5 U	<5 U	<100 U	<10 U	<0.5 U

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration; NR = analysis not requested.

Table 22. Volatile organic compound (VOC) concentrations[1] of unfiltered water samples collected for verification purposes during the third quarter, 2004. Concentrations are expressed in µg/L.

Sample Site/Analyte	MDL	Result
ANP-8		
Tetrachloroethylene	0.04	4.9
Trichloroethylene	0.07	20.0
TAN-16		
Cis-1,2-Dichloroethene	0.50	1.4
Tetrachloroethylene	0.50	7.8
Trichloroethylene	0.50	44.9
TAN-28		
Cis-1,2-Dichloroethene	1.00	112.0
Trans-1,2-Dichloroethene	1.30	83.0
Tetrachloroethylene	0.40	14.0
Trichloroethylene	3.50	921.0
Vinyl Chloride	2.50	5.8
TAN-29		
1,1-Dichloroethene	4.90	1.1
Cis-1,2-Dichloroethene	0.50	116.0
Trans-1,2-Dichloroethene	0.65	88.0
Tetrachloroethylene	0.04	15.7
Trichloroethylene	3.50	787.0
Vinyl Chloride	0.25	2.9
Chloroform	0.25	0.62
TAN-37A		
Cis-1,2-Dichloroethene	0.10	35.0
Trans-1,2-Dichloroethene	3.25	133.0
Tetrachloroethylene	0.04	1.1
Trichloroethylene	1.75	95.0
Vinyl Chloride	0.25	6.6
Chloroform	0.25	0.57
TAN-51		
Cis-1,2-Dichloroethene	0.50	4.2
Trans-1,2-Dichloroethene	0.50	1.3
Tetrachloroethylene	0.50	23.3
1,1,1,-Trichloroethane	0.50	0.8
Trichloroethylene	0.50	179.0
Chloroform	0.50	0.5
1,1-Dichloroethane	0.50	0.6
TAN-57		
Tetrachloroethylene	0.04	2.3
Trichloroethylene	0.07	4.7

[1] Data qualifiers: U = non-detection, J = estimate, R = rejected. MDC – Minimum Detectable Concentration.

Terrestrial Monitoring Results

The ESP conducts terrestrial (soil and milk) monitoring and verification to provide an indication as to the long-term deposition and migration of contaminants in the environment, and to provide independent verification of DOE's analytical measurement of terrestrial variables.

Results for analyses of milk samples, which are collected monthly, are presented in **Table 23**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131, a man-made radionuclide, was not detected.

DEQ-INL monitors long-term radiological conditions using measurement devices capable of identifying and measuring quantities of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides insight to the transport, deposition, and accumulation of radioactive material in the environment as a result of INEEL operations and the historic atmospheric testing of nuclear weapons. *In-situ* gamma spectroscopic measurements were conducted at 17 locations including onsite, boundary and distant monitoring locations during the third quarter of 2004. Twelve "puck" soil samples were collected from six locations during the third quarter of 2004 to verify soil sampling results attained by the DOE offsite monitoring contractor (ESER). A comparison of these results is presented in an annual DEQ-INL ESP report. Gamma spectroscopic analysis results are shown in **Table 24**.

Table 23. Gamma spectroscopy analysis data for milk samples, third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40 (pCi/L)		Man-made gamma-emitting radionuclide Iodine-131[1]
		Concentration	± 2 SD	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	07/06/04	1628	110	<MDC
	08/10/04	1400	113	<MDC
	09/07/04	1707	115	<MDC
Mud Lake/Nelson-Ricks Creamery	07/06/04	1451	112	<MDC
	08/10/04	1825	120	<MDC
	09/07/04	1814	119	<MDC
Rupert-Minidoka/Kraft	07/06/04	1504	118	<MDC
	08/10/04	1531	116	<MDC
	09/07/04	1685	115	<MDC
Gooding/Glanbia	07/06/04	1691	113	<MDC
	08/10/04	1747	116	<MDC
	09/07/04	1750	122	<MDC
Pocatello/Meadow Gold	07/06/04	1465	112	<MDC
	08/10/04	1441	117	<MDC

Table 23 continued. Gamma spectroscopy analysis data for milk samples, third quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40 (pCi/L)		Man-made gamma-emitting radionuclide Iodine-131[1]
		Concentration	± 2 SD	
Verification Samples[2]				
Idaho Falls	08/03/04	1620	114	<MDC
Moreland	08/03/04	1495	118	<MDC
Moreland	09/07/04	1692	120	<MDC
Rupert	07/06/04	1544	121	<MDC
Terreton	07/06/04	1545	122	<MDC
Terreton	09/07/04	1595	114	<MDC

[1] <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for Iodine-131).
[2] DEQ-INL samples collected by the offsite INEEL environmental surveillance contractor.

Table 24. Gamma spectroscopic analysis results for soil monitoring conducted during the third quarter of 2004. Verification "puck" soil samples analyzed via gamma spectroscopy. *In-Situ* gamma spectroscopy conducted by DEQ-INL. Spectroscopy assumed radioisotopes to be homogeneously distributed in soil for a depth of 5-cm and a soil density of 1.5 g/mL. Concentrations are reported in pCi/g.

Location	Sample Type	Sample Depth (cm)	Sample Date	Cesium-137			Potassium-40		
				Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
St. Anthony	Puck	0 - 5	7/22/2004	0.77	0.1	0.1	18.4	2.3	1.7
St. Anthony	Puck	5 - 10	7/22/2004	0.46	0.08	0.1	21.6	2.4	1.9
Mud Lake 1	Puck	0 - 5	7/22/2004	0.53	0.08	0.09	18.5	2.3	1.4
Mud Lake 1	Puck	5 - 10	7/22/2004	0.09	0.05	0.1	18.8	2.4	1.7
Mud Lake 2	Puck	0 - 5	7/22/2004	0.08	0.04	0.06	17.8	2.3	1.5
Mud Lake 2	Puck	5 - 10	7/22/2004	0.15	0.05	0.07	18.5	2.3	1.5
Monteview	Puck	0 - 5	7/22/2004	0.46	0.07	0.08	21.3	2.4	2
Monteview	Puck	5 - 10	7/22/2004	0.19	0.05	0.06	18.8	2.4	1.6
Howe	Puck	0 - 5	7/22/2004	0.28	0.07	0.08	12.7	1.8	1.6
Howe	Puck	5 - 10	7/22/2004	0.03	0.04	0.06	11.5	1.8	1.6
Reno Ranch	Puck	0 - 5	7/22/2004	0.55	0.09	0.09	11.2	1.6	1.4
Reno Ranch	Puck	5 - 10	7/22/2004	0.21	0.07	0.1	13.1	1.7	1.4
Sand Dunes	*in situ*	0 - 5	9/2/2004	0.19	0.04	0.03	14.2	2.9	0.5
Monteview	*in situ*	0 - 5	9/2/2004	0.20	0.04	0.03	13.2	2.7	0.5
Terreton/ MudLake	*in situ*	0 - 5	9/2/2004	0.21	0.05	0.03	13.1	2.6	0.5
Main Gate	*in situ*	0 - 5	9/2/2004	0.47	0.10	0.04	17.2	3.5	0.6
Experimental Field Station	*in situ*	0 - 5	9/2/2004	0.34	0.07	0.04	15.9	3.2	0.5
Idaho Falls	*in situ*	0 - 5	9/1/2004	0.35	0.07	0.03	11.3	2.3	0.5

Table 24 continued. Gamma spectroscopic analysis results for soil monitoring conducted during the third quarter of 2004. Verification "puck" soil samples analyzed via gamma spectroscopy. *In-Situ* gamma spectroscopy conducted by DEQ-INL. Spectroscopy assumed radioisotopes to be homogeneously distributed in soil for a depth of 5-cm and a soil density of 1.5 g/mL. Concentrations are reported in pCi/g.

Location	Sample Type	Sample Depth (cm)	Sample Date	Cesium-137			Potassium-40		
				Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
Batise Springs 1	*in situ*	0 - 5	9/9/2004	0.49	0.10	0.04	13.9	2.8	0.5
Batise Springs 2	*in situ*	0 - 5	9/9/2004	0.63	0.13	0.05	14.0	2.8	0.5
Rover	*in situ*	0 - 5	9/9/2004	0.31	0.07	0.03	17.7	3.6	0.6
Big Lost River Rest Area	*in situ*	0 - 5	9/8/2004	0.49	0.10	0.04	18.6	3.7	0.6
Howe	*in situ*	0 - 5	9/9/2004	0.45	0.09	0.04	13.5	2.7	0.5
Fort Hall	*in situ*	0 - 5	9/8/2004	0.14	0.03	0.03	13.4	2.7	0.5
FAA Tower	*in situ*	0 - 5	9/8/2004	0.56	0.12	0.04	15.7	3.2	0.5
Crystal Ice Caves	*in situ*	0 - 5	9/8/2004	0.48	0.10	0.04	15.8	3.2	0.5
Big Southern Butte	*in situ*	0 - 5	9/8/2004	0.44	0.09	0.05	19.7	4.0	0.8
Base of Howe Peak	*in situ*	0 - 5	9/9/2004	0.50	0.10	0.04	15.0	3.0	0.5
Atomic City	*in situ*	0 - 5	9/8/2004	0.50	0.10	0.04	15.8	3.2	0.5

Quality Assurance

The measurement of any physical quantity is subject to uncertainty from errors that may be introduced during sample collection, measurement, calibration, and the reading and reporting of results. While the sum of these inaccuracies cannot be quantified for each analytical result, a quality assurance program can evaluate the overall quality of a data set and possibly identify and address errors or inaccuracies.

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the third quarter of 2004 for the DEQ-INL's ESP. It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for nonradiological analyses and to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses during the quarter. All analyses and QC measures at the analytical laboratories used by the ESP are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL.

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the third quarter of 2004, the DEQ-INL submitted 75 QC samples for various radiological and nonradiological analyses (**Table 25**).

Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or unmeasurable amounts of the analyte(s) of interest in them. They are designed to determine if analyses will provide a "zero" result when no contaminant is expected to be present or an acceptable measure of "background," and therefore monitor any bias that may have been introduced during sample collection, storage, shipment, and analysis. Blank sample results submitted for gross alpha and gross beta screening in air for the third quarter of 2004 are presented in **Table 26**. Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 27.** Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 28**. Blank analysis results for metals, common ion, and nutrients in ground and surface water for the third quarter of 2004 are found in **Tables 29 and 30**. Blank analyses results for cesium-137, potassium-40, tritium, enriched tritium, gross alpha, and gross beta in ground and surface water media are presented in **Table 31**.

No anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL for the third quarter of 2004.

Duplicate Samples

Duplicate samples are collected in a manner such that the samples are thought to be essentially identical in composition and are used to assess analytical precision. The difference between the original sample and the duplicate sample is expressed as a relative percent difference (RPD) and is used to measure a laboratory's ability to reproduce consistent results. For radiological analyses, the standard deviation of the differences can be used as an indicator of the overall precision of the data set. Duplicate results for ground and surface water are presented in **Table 32** for radiological analyses. Duplicate results for metals and common ion and nutrients in ground and surface water are presented in **Table 33 and 34**.

No anomalies were observed from the assessment of field duplicate samples as measured by the analytical laboratories used by DEQ-INL for the third quarter of 2004.

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added in order to assess the bias a laboratory may have in accurately measuring these analytes. To determine agreement after laboratory analysis, DEQ-INL calculates the difference between the known concentration in the sample and the measured concentration by the laboratory. This result is known as percent recovery (%R) and the acceptable range used by DEQ-INL is 100 ± 25 percent. During third quarter, no field matrices were spiked to assess the influence of the sample media on laboratory performance. However, spiked de-ionized water samples were submitted for nonradiological groundwater constituents and the results are summarized in **Tables 35 and 36** for the third quarter of 2004.

One anomaly occurred during the third quarter of 2004 concerning spikes used to assess groundwater analytical performance. DEQ-INL made an error when requesting spiked samples made at the contract laboratory for subsequent analysis. Samples for total nitrogen and total phosphorus were spiked at a level near the laboratory's MDC making assessment of the laboratory's analytical performance difficult for these two analytes. To remedy this situation from reoccurring, additional information will be provided in the DEQ-INL ESP Quality Assurance Program Plan (QAPP) for spike sample requirements, control, and documentation. In addition, DEQ-INL will secure an outside vendor to prepare blind matrix spike samples in the future.

DEQ-INL also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL irradiates a number of electret ionization chambers (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and a "blind" exposure ranging from 20 to 50 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement agrees within 25 percent of the known irradiated quantity. The irradiation results for third quarter 2004 are presented in **Table 37.**

During third quarter, one irradiated EIC spike used to determine measurement accuracy failed the recovery criteria of 100 ± 25 percent. Since three other spiked EIC measurements were within specification, no additional action was taken with the data. However, DEQ-INL has determined that the higher than normal background measurements used to assess EIC performance for the third quarter may be the contributing factor to this failure. Patterns observed for this quarter's spiked EICs show that all measurements were above 100 percent recovery. After review of historical trends, DEQ-INL observed that measurements recorded in a quarter with low background yielded uniformly lower percent recoveries (e.g. second quarter, 2004). DEQ-INL will review how background measurements are conducted and integrated into the EIC measurement calculations and make appropriate adjustments to prevent this anomaly from reoccurring.

No other anomalies were observed from the assessment of spiked samples as measured by DEQ-INL or the analytical laboratories used by DEQ-INL for the third quarter of 2004.

Analytical QA/QC Assessment

No issues involving sample chain of custody, sample holding times, the analysis of blank, duplicate, and spiked samples were observed during the third quarter of 2004 which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL. No transcription errors were noted for third quarter 2004 data.

Data usability is the measure of data that is not rejected compared to the amount that was expected to be obtained. The overall data usability rate for the third calendar quarter of 2004 met the criteria of the DEQ-INL ESP and is summarized is **Table 25.** However, four groundwater data points were rejected for the quarter because of a failure of ISU-EML to meet laboratory duplicate quality control parameters for gross alpha and gross beta. Further investigation revealed that the error was not attributed to analytical problems with radiological sample counting, but to inadequate sample preparation because of a failure to properly homogenize two samples prior to creating a duplicate. To salvage these data, DEQ-INL estimated sample concentrations by adding together the activity from both the original and duplicate samples and recalculated the concentration (in pCi/L) to yield a usable result for each sample. These results were labeled as estimates in the DEQ-INL database. Other samples which were split for laboratory duplicate analysis at ISU-EML did not appear to exhibit the disparity and were not qualified.

Additionally, several minor reporting errors by IBL were discovered by DEQ-INL during the third quarter of 2004 and corrective actions are underway to prevent their reoccurrence.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the third quarter of 2004 is summarized in **Table 38**. Air sampling equipment requiring repair included:

- The intermediate-flow PM_{10} sampler totalizer at the Mud Lake monitoring station (totalizer replaced - repair completed).
- The low-volume air sampler (radioiodine sampler pump) at the Sand Dunes Tower monitoring station (pump replaced - repair completed).
- The low-volume air sampler (radioiodine sampler pump) at the Idaho Falls monitoring station (pump replaced - repair completed).
- The total suspended particulate (TSP) blower motor at the Mud Lake monitoring station (motor replaced - repair completed).
- The low-volume air sampler (radioiodine sampler pump) at the Howe monitoring station (pump replaced - repair completed).
- The tritium sampler pump at the Big Lost River Rest Area monitoring station (not repaired - low-volume air samplers at this location are being used to sample both radioiodine and tritium).
- Two tritium sampler pumps at the Atomic City monitoring station (pumps replaced - repairs completed).

Conclusion

All data collected for the third quarter of 2004 have been assigned the applicable qualifiers to designate the appropriate use of the data. In addition, all data has been verified and deemed complete, meeting the requirements and data quality objectives established by DEQ-INL.

Table 25. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL ESP for third quarter, 2004.

Media Sampled	Collection Device	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected[1]	Analyzing Lab[2]
AIR								
Particulate (Does not include PM_{10} measurements)	4 inch filter	Gross alpha	143	13	0	0	0	ISU-EML
		Gross beta	143	13	0	0	0	ISU-EML
		Gamma emitters	11	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Particulate	Desiccant column	Tritium	49	9	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	5	0	0	0	0	ISU-EML
		Gamma emitters	5	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	23	1	2	0	2	ISU-EML
		Gross beta	23	1	2	0	2	ISU-EML
		Gamma emitters	23	1	2	0	0	ISU-EML
		Tritium	27	1	2	0	0	ISU-EML
		Enriched tritium	16	1	2	0	0	ISU-EML
		Technetium-99	0	0	0	0	0	ISU-EML
		Radiochemical	7	0	0	0	0	ISU Sub
		Metals	22	1	2	1	0	IBL
		Common Ions	22	1	2	1	0	IBL
		Nutrients	22	1	2	1	0	IBL
		Volatile Organics	11	0	0	0	0	IBL Sub
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	20	0	0	0	0	ISU-EML
Soil	*in situ*	Gamma emitters	17	0	0	0	0	DEQ-INL
	Grab – "puck"	Gamma emitters	12	0	0	0	0	ISU-EML
RADIATION								
Ambient Air	EICs	Gamma Radiation	93	4	0	8	0	DEQ-INL
	HPICs	Gamma Radiation	NA	NA	NA	NA	NA	DEQ-INL
Total Analyses			707	48	16	11	4	
Total of QC Analyses (blanks, duplicates, and spikes)						75		
Percentage of QC analyses of total analyses[3]						10.6		
Percentage of usable data[4]						99.43		

[1] Combined Laboratory and DEQ-INL rejection criteria (data was rejected for any reason).
[2] ISU-EML = Idaho State University – Environmental Monitoring Laboratory; ISU Sub = Subcontract laboratory to ISU-EML; IBL = Idaho Bureau of Laboratories, Boise; IBL Sub = Subcontract laboratory to IBL; DEQ-INL = Analyzed by INEEL Oversight and Radiation Control, Idaho Department of Environmental Quality.
[3] Analyzing quality control samples at a rate of approximately 5 to 10 percent of the total number of analyses performed for the year is deemed appropriate for the DEQ-INL ESP.
[4] Data usability rate [total analyses – rejected data]/[total analyses] of 90 percent or higher is acceptable for the DEQ-INL ESP.

Table 26. Blank analysis results for gross alpha and beta in particulate air (TSP) for the third quarter, 2004. Concentrations[1] and associated uncertainties (2 SD) are expressed in 1 x 10^{-3} pCi/m^3.

Collection Period		Corrected volume (m^3) [1]	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
07/01/04	07/08/04	1695	0.1	0.1	0.3	0.2
07/08/04	07/15/04	1695	0.0	0.2	0.5	0.3
07/15/04	07/22/04	1695	0.0	0.1	0.0	0.2
07/22/04	07/29/04	1695	0.0	0.1	0.1	0.2
07/29/04	08/05/04	1695	0.0	0.1	0.1	0.2
08/05/04	08/12/04	1695	-0.1	0.2	-0.1	0.2
08/12/04	08/19/04	1695	0.0	0.1	0.0	0.2
08/19/04	08/26/04	1695	0.0	0.1	-0.1	0.2
08/26/04	09/02/04	1695	-0.1	0.1	-0.1	0.2
09/02/04	09/09/04	1695	0.0	0.1	0.0	0.2
09/09/04	09/16/04	1695	0.0	0.1	-0.1	0.2
09/16/04	09/23/04	1695	0.0	0.2	-0.2	0.2
09/23/04	09/30/04	1695	0.0	0.1	0.2	0.2

[1] A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters.

Table 27. Blank analysis results for gamma spectroscopy for TSP particulate air filters for the third quarter, 2004. Concentrations[1] are expressed in 1 x 10^{-5} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Berillium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/18/2004	1	24	42	0	25	44	-2	6	11

[1] These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.

Table 27 continued. Blank analysis results for gamma spectroscopy for TSP particulate air filters for the third quarter, 2004. Concentrations[1] are expressed in 1x10^{-5} pCi/m^3 with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Cesium-134			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
10/18/2004	-1	3	5	2	3	5

[1] These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.

Table 28. Blank analysis results for tritium water vapor from air samples for the third quarter, 2004 . Concentrations are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP043ZTR01	08/31/04	08/31/04	09/03/04	0.06	0.07	0.11
OP043ZTR02	08/31/04	08/31/04	09/03/04	0.04	0.07	0.11
OP043ZTR03	09/15/04	09/15/04	09/16/04	0.09	0.08	0.14
OP043ZTR04	09/15/04	09/15/04	09/16/04	0.06	0.08	0.14
OP043ZTR05	10/13/04	10/13/04	10/14/04	0.02	0.07	0.13
OP043ZTR06	10/13/04	10/13/04	10/14/04	-0.06	0.07	0.12
OP043ZTR07	11/02/04	11/02/04	11/04/04	0.03	0.07	0.12
OP043ZTR08	11/02/04	11/02/04	11/04/04	-0.02	0.07	0.12

Table 29. Blank analysis results (in :g/L) for metals in ground and surface water for the third quarter, 2004.

Blank Sample Number	Sample Date	Barium	Chromium	Manganese	Lead	Zinc
043W090	8/17/2004	<2	<5	<2	<5	<5

Table 30. Blank analysis results (in mg/L) for common ion and nutrients in ground and surface water for the third quarter, 2004.

Blank Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity as CaCO3	Total Nitrogen	Total Phosphorus
043W089, 090, and 091	8/17/2004	<0.1	<0.1	<0.1	<0.1	<0.1	<2	<2	<1	<0.005	<0.005

Table 31. Blank analysis results for cesium-137, potassium-40, tritium, enriched tritium, gross alpha, and gross beta in ground and surface water samples for the third quarter, 2004. Concentrations[1] are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Sample Number	Cesium-137			Potassium-40			Tritium			Enriched Tritium			Gross Alpha			Gross Beta		
	Concentration	±2 SD	MDC	Concentration	±2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
043W087	0.5	1.4	2.3	-33	49	83	NR[1]	-	-	NR[1]	-	-	0.0	0.6	1.0	0.7	0.8	1.3
043W088	NR[1]	-	-	NR[1]	-	-	-20	70	120	42	7	8	NR[1]	-	-	NR[1]	-	-

[1] NR = analysis not requested.

Table 32. Duplicate radiological analysis results (in pCi/L) for ground and surface water, third quarter, 2004.

Analysis/ Sample Location	Original Sample Number	Analysis Date	Concentration	± 2 SD	Duplicate Sample Number	Analysis Date	Concentration	± 2 SD	$/R_1-R_2/$	$3(s_1^2+s_2^2)^{1/2}$	Within Criteria?[1]
Gross Alpha											
MV-03	04MV001	9/13/2004	4.0	2.1	04MV061	9/17/2004	5.0R[2]	2.5	NA	NA	NA
Shoshone Water Supply	043W031	10/1/2004	1.0	1.9	043W036	10/4/2004	1.5	2.0	0.5	8.3	Yes
Gross Beta											
MV-03	04MV001	9/13/2004	3.6	1.0	04MV061	9/17/2004	1.5R[2]	1.1	NA	NA	NA
Shoshone Water Supply	043W031	10/1/2004	3.3	1.0	043W036	10/4/2004	2.7	1.0	0.6	4.2	Yes
Gamma Spectroscopy Cesium-137											
MV-03	04MV001	7/30/2004	-0.3	1.6	04MV061	8/3/2004	-0.3	1.6	0.0	6.8	Yes
Shoshone Water Supply	043W031	8/30/2004	0.1	1.6	043W036	8/31/2004	1.0	1.7	0.9	7.0	Yes
Gamma Spectroscopy Potasium-40											
MV-03	04MV001	7/30/2004	17	51	04MV061	8/3/2004	-12	49	29.0	212.2	Yes
Shoshone Water Supply	043W031	8/30/2004	-4	49	043W036	8/31/2004	29	51	33.0	212.2	Yes
Tritium											
MV-03	04MV002	8/26/2004	60.0	60.0	04MV062	8/26/2004	60.0	60.0	0.0	254.6	Yes
Shoshone Water Supply	043W032	9/7/2004	0.0	70.0	043W037	9/7/2004	30.0	70.0	30.0	297.0	Yes
Enriched Tritium											
MV-03	04MV002	12/13/2004	-2.0	5.0	04MV062	12/13/2004	-3.0	5.0	1	21.2	Yes
Shoshone Water Supply	043W032	10/27/2004	22.0	6.0	043W037	10/27/2004	27.0	7.0	5	27.7	Yes
Technicium-99											
None											
Strontium-90											
None											

[1] $/R_1-R_2/ \leq 3(s_1^2+s_2^2)^{1/2}$
[2] Duplicate analysis result rejected because of laboratory error. No comparison possible (NA).

Table 33. Duplicate results (in µg/L) for metals in ground and surface water for the third quarter, 2004. Relative percent difference (RPD) is acceptable at < 20 percent. Data are presented in the table in the format of "original result/duplicate result (RPD)."

Sample Location	Sample Number	Duplicate Sample Number	Barium	Chromium	Manganese	Lead	Zinc
MV-03	04MV004	04MV064	22/23 (4.4)	<5/<5 (0.0)	<2/<2 (0.0)	<5/<5 (0.0)	<5/<5 (0.0)
Shoshone Water Supply	043W034	043W038	39/39 (0.0)	<5/<5 (0.0)	<2/<2 (0.0)	<5/<5 (0.0)	7/7 (0.0)

Table 34. Duplicate sample results (in mg/L) for common ions, and nutrients in ground and surface water for the third quarter, 2004. Relative percent difference (RPD) is acceptable at < 20 percent. Data are presented in the table in the format of "original result/duplicate result (RPD)."

Sample Location	Sample Number	Duplicate Sample Number	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity as CaCO3	Total Nitrogen	Total Phosphorus
MV-03	04MV003, 004, 005	04MV063, 064, 065	38/40 (5.1)	15.6/16.2 (3.8)	23/23 (0.0)	3.5/3.4 (2.9)	0.85/0.86 (1.2)	26.8/27.2 (1.5)	34/34.1 (0.3)	133/132 (0.8)	1.37/1.37 (0.0)	0.015/0.014 (6.9)
Shoshone Water Supply	043W033, 034, 035	043W038, 039, 040	42/42 (0.0)	14.7/14.7 (0.0)	14/14 (0.0)	3/3 (0.0)	0.41/0.41 (0.0)	6.21/6.41 (3.2)	15.5/15.6 (0.6)	166/166 (0.0)	1.16/1.16 (0.0)	0.022/0.023 (4.4)

Table 35. De-ionized water spike results (in µg/L) for metals in ground and surface water for the third quarter, 2004. A percent recovery of 100 ± 25 is considered acceptable and is recorded in parentheses (%R).

Spike Sample Number	Sample Date	Barium	Chromium	Lead	Manganese	Zinc
		Reference Spike Concentration				
		NA	20.0	20.0	5.0	20.0
043W082	8/11/2004	<2	20 (100)	22 (109.5)	5 (100)	21 (105)

Table 36. De-ionized water spike results (in mg/L) for common ions, and nutrients in ground and surface water for the third quarter, 2004. A percent recovery of 100 ± 25 is considered acceptable and is recorded in parentheses (%R).

Spike Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity as CaCO3	Total Nitrogen	Total Phosphorus
		Reference Spike Concentration									
		10.0	10.0	10.0	10.0	1.0	20.0	20.0	NA	0.005	0.005
043W081, 082, and 083	8/11/04	10.2 (102)	10.2 (102)	10.0 (100)	9.8 (98)	1.07 (107)	21.3 (106.3)	20.6 (103)	<1	<0.005 (NA)[1]	0.008 (NA)[1]

[1] Samples were inadvertently spiked at the laboratory's MDC for this analyte. A meaningful evaluation was not possible.

Table 37. Electret ionization chamber irradiation results (categorized as spiked samples) for third quarter, 2004. A percent recovery (%R) of 100 ± 25 is considered acceptable.

Electret #	Exposure Received		Gross Measured Exposure		Background[1]		Net Exposure[2]		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty[3] (mR)	
S1	30.0	1.50	35.4	1.24	0.47	0.68	34.9	1.41	116
S2	30.0	1.50	36.4	1.33	0.47	0.68	35.9	1.49	120
S3	30.0	1.50	37.4	1.38	0.47	0.68	36.9	1.54	123
S4	30.0	1.50	35.9	1.32	0.47	0.68	35.5	1.48	118
S5	45.0	2.25	50.3	1.41	0.47	0.68	49.9	1.57	111
S6	45.0	2.25	53.5	1.41	0.47	0.68	53.1	1.56	118
S7	45.0	2.25	62.5	1.41	0.47	0.68	62.1	1.56	138
S8	45.0	2.25	52.2	1.34	0.47	0.68	51.8	1.50	115

[1] Four EICs were used for control measurements (counted as blanks) and were not irradiated. Background exposure, as measured by the control group, was 0.47 ± 0.68 mR.
[2] [Gross Measured Exposure] – [Background].
[3] Total propagated error.

Table 38. Air sampling field equipment service reliability (percent operational) for third quarter 2004. These values were calculated by dividing the number of weeks the equipment was in operation by the number of weeks in the quarter.

Station Locations	Sample Type[1]				
	PM_{10}	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations					
Big Lost River Rest Area	NC	100%	100%	92%	100%
Experimental Field Station	NC	100%	100%	100%	NC
Sand Dunes Tower	NC	100%	92%	92%	NC
Van Buren Avenue	NC	100%	100%	100%	NC
Boundary Locations					
Atomic City	100%	100%	CP	85%	100%
Howe	NC	100%	92%	92%	NC[2]
Monteview	NC	100%	100%	100%	100%
Mud Lake	100%	100%	CP	100%	100%
Distant Locations					
Craters of the Moon	NC	100%	100%	100%	NC
Fort Hall[3]	NC	100%	100%	100%	NC
Idaho Falls	NC	100%	92%	100%	100%

[1] NC = sample not collected at this location; CP = sample collected using the PM_{10} sampler at this location.
[2] Precipitation sampling was discontinued during the sampling period due to contamination caused from irrigation water.
[3] Operated by Shoshone-Bannock Tribes.

Appendix A

Table A1. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Onsite Locations						
Big Lost River Rest Area	07/01/04	07/08/04	1.0	0.2	18.4	0.9
	07/08/04	07/15/04	0.8	0.2	20.7	0.9
	07/15/04	07/22/04	0.8	0.2	19.2	0.9
	07/22/04	07/29/04	0.9	0.2	24.1	1.0
	07/29/04	08/05/04	1.4	0.3	31.2	1.1
	08/05/04	08/12/04	1.0	0.3	26.7	1.0
	08/12/04	08/19/04	1.0	0.2	29.3	1.0
	08/19/04	08/26/04	1.3	0.2	19.0	0.9
	08/26/04	09/02/04	0.7	0.2	16.9	0.8
	09/02/04	09/09/04	0.9	0.2	20.5	0.9
	09/09/04	09/16/04	0.8	0.2	21.0	0.9
	09/16/04	09/23/04	0.5	0.2	19.2	0.9
	09/23/04	09/30/04	1.0	0.2	32.4	1.1
Experimental Field Station	07/01/04	07/08/04	1.3	0.2	19.9	0.9
	07/08/04	07/15/04	0.7	0.2	19.1	0.9
	07/15/04	07/22/04	0.6	0.2	19.4	1.0
	07/22/04	07/29/04	0.8	0.2	22.6	1.0
	07/29/04	08/05/04	1.2	0.2	27.0	1.0
	08/05/04	08/12/04	0.8	0.2	23.6	0.9
	08/12/04	08/19/04	1.0	0.2	32.0	1.1
	08/19/04	08/26/04	0.9	0.2	19.9	1.0
	08/26/04	09/02/04	0.7	0.2	17.2	0.8
	09/02/04	09/09/04	1.2	0.2	17.6	0.8
	09/09/04	09/16/04	1.1	0.2	19.3	0.9
	09/16/04	09/23/04	0.8	0.2	18.6	0.9
	09/23/04	09/30/04	0.9	0.2	28.0	1.0

Table A1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes Tower	07/01/04	07/08/04	0.8	0.2	16.4	0.8
	07/08/04	07/15/04	0.7	0.2	18.8	0.8
	07/15/04	07/22/04	0.5	0.3	18.5	1.2
	07/22/04	07/29/04	0.7	0.2	21.2	0.9
	07/29/04	08/05/04	1.0	0.2	24.8	0.9
	08/05/04	08/12/04	0.6	0.2	21.0	0.8
	08/12/04	08/19/04	0.9	0.2	28.8	1.0
	08/19/04	08/26/04	0.9	0.2	16.6	0.8
	08/26/04	09/02/04	0.5	0.2	13.8	0.7
	09/02/04	09/09/04	0.9	0.2	18.6	0.8
	09/09/04	09/16/04	0.7	0.2	16.4	0.8
	09/16/04	09/23/04	0.8	0.2	15.5	0.7
	09/23/04	09/30/04	0.6	0.2	24.4	0.9
Van Buren Avenue	07/01/04	07/08/04	0.8	0.2	20.9	0.9
	07/08/04	07/15/04	1.0	0.2	23.3	0.9
	07/15/04	07/22/04	0.9	0.2	20.9	0.9
	07/22/04	07/29/04	1.1	0.2	25.2	1.0
	07/29/04	08/05/04	1.2	0.3	33.9	1.4
	08/05/04	08/12/04	0.9	0.3	27.7	1.0
	08/12/04	08/19/04	1.5	0.3	37.9	1.2
	08/19/04	08/26/04	1.0	0.2	20.2	0.9
	08/26/04	09/02/04	0.7	0.2	18.8	0.9
	09/02/04	09/09/04	0.8	0.2	21.1	0.9
	09/09/04	09/16/04	0.9	0.2	22.5	0.9
	09/16/04	09/23/04	0.7	0.2	19.4	0.9
	09/23/04	09/30/04	1.1	0.3	32.9	1.1
Boundary Locations						
Atomic City	07/01/04	07/08/04	1.1	0.2	20.3	0.9
	07/08/04	07/15/04	1.2	0.3	22.5	1.0
	07/15/04	07/22/04	1.1	0.2	20.8	0.9
	07/22/04	07/29/04	0.9	0.2	25.8	1.0
	07/29/04	08/05/04	1.5	0.3	30.4	1.1
	08/05/04	08/12/04	1.1	0.3	24.3	1.0
	08/12/04	08/19/04	1.3	0.3	34.9	1.2
	08/19/04	08/26/04	0.9	0.2	20.6	0.9
	08/26/04	09/02/04	1.0	0.2	19.5	0.9
	09/02/04	09/09/04	1.2	0.2	22.9	1.0
	09/09/04	09/16/04	1.1	0.2	23.8	1.0
	09/16/04	09/23/04	0.9	0.2	21.7	0.9
	09/23/04	09/30/04	1.2	0.3	35.1	1.2

Table A1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	07/01/04	07/08/04	0.8	0.2	19.3	0.9
	07/08/04	07/15/04	0.9	0.2	19.8	0.9
	07/15/04	07/22/04	0.4	0.2	17.6	0.8
	07/22/04	07/29/04	0.8	0.2	20.8	0.9
	07/29/04	08/05/04	1.0	0.2	26.7	1.0
	08/05/04	08/12/04	0.8	0.2	22.4	0.9
	08/12/04	08/19/04	1.0	0.2	28.0	1.0
	08/19/04	08/26/04	0.8	0.2	17.5	0.8
	08/26/04	09/02/04	0.6	0.2	15.3	0.8
	09/02/04	09/09/04	0.6	0.2	17.5	0.8
	09/09/04	09/16/04	0.8	0.2	16.7	0.8
	09/16/04	09/23/04	0.4	0.2	15.9	0.8
	09/23/04	09/30/04	0.6	0.2	27.6	1.0
Monteview	07/01/04	07/08/04	0.7	0.2	14.4	0.7
	07/08/04	07/15/04	0.8	0.2	15.4	0.8
	07/15/04	07/22/04	0.6	0.2	16.0	0.9
	07/22/04	07/29/04	1.0	0.2	18.5	0.8
	07/29/04	08/05/04	1.3	0.2	22.1	0.9
	08/05/04	08/12/04	0.8	0.2	17.3	0.8
	08/12/04	08/19/04	1.2	0.2	24.2	0.9
	08/19/04	08/26/04	0.8	0.2	14.9	0.7
	08/26/04	09/02/04	0.5	0.2	10.7	0.6
	09/02/04	09/09/04	1.0	0.2	15.0	0.7
	09/09/04	09/16/04	0.7	0.2	14.2	0.7
	09/16/04	09/23/04	0.7	0.2	14.2	0.7
	09/23/04	09/30/04	0.7	0.2	21.4	0.8
Mud Lake	07/01/04	07/08/04	1.0	0.2	16.5	0.8
	07/08/04	07/15/04	0.7	0.2	17.3	0.8
	07/15/04	07/22/04	1.6	0.3	16.8	0.9
	07/23/04	07/29/04	0.8	0.3	20.9	1.0
	07/29/04	08/05/04	1.3	0.2	24.7	1.0
	08/05/04	08/12/04	0.8	0.2	21.2	0.9
	08/12/04	08/19/04	1.2	0.2	23.0	0.9
	08/19/04	08/26/04	0.9	0.2	17.6	0.8
	08/26/04	09/02/04	0.5	0.2	14.6	0.7
	09/02/04	09/09/04	1.1	0.2	19.4	0.8
	09/09/04	09/16/04	0.9	0.2	17.2	0.8
	09/16/04	09/23/04	0.7	0.2	15.5	0.8
	09/23/04	09/30/04	0.8	0.2	25.8	0.9

Table A1 continued. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for TSP filters for all locations, third quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters of the Moon	07/01/04	07/08/04	0.7	0.2	17.2	0.8
	07/08/04	07/15/04	0.8	0.2	17.6	0.8
	07/15/04	07/22/04	1.0	0.3	16.4	1.0
	07/22/04	07/29/04	0.9	0.2	19.4	0.9
	07/29/04	08/05/04	0.9	0.2	24.8	1.0
	08/05/04	08/12/04	0.6	0.2	20.8	0.9
	08/12/04	08/19/04	1.0	0.2	25.8	1.0
	08/19/04	08/26/04	0.9	0.2	14.4	0.8
	08/26/04	09/02/04	0.7	0.3	14.2	0.9
	09/02/04	09/09/04	0.8	0.2	16.7	0.8
	09/09/04	09/16/04	0.8	0.2	16.8	0.8
	09/16/04	09/23/04	0.4	0.2	14.9	0.8
	09/23/04	09/30/04	1.1	0.3	28.2	1.1
Fort Hall[1]	07/01/04	07/08/04	1.1	0.2	17.3	0.8
	07/08/04	07/15/04	1.3	0.2	15.8	0.8
	07/15/04	07/22/04	1.3	0.2	17.1	0.8
	07/22/04	07/29/04	1.6	0.3	20.6	0.9
	07/29/04	08/05/04	1.7	0.3	24.6	0.9
	08/05/04	08/12/04	1.0	0.2	18.5	0.8
	08/12/04	08/19/04	1.5	0.2	21.7	0.9
	08/19/04	08/26/04	1.0	0.2	15.3	0.7
	08/26/04	09/02/04	1.2	0.2	13.0	0.7
	09/02/04	09/09/04	1.1	0.2	15.8	0.8
	09/09/04	09/16/04	1.2	0.2	15.6	0.8
	09/16/04	09/23/04	0.6	0.2	15.3	0.7
	09/23/04	09/30/04	1.1	0.2	21.4	0.9
Idaho Falls	07/01/04	07/08/04	0.8	0.2	19.1	0.8
	07/08/04	07/15/04	0.8	0.2	18.5	0.8
	07/15/04	07/22/04	0.7	0.2	19.5	0.9
	07/22/04	07/29/04	0.9	0.2	24.4	1.0
	07/29/04	08/05/04	1.4	0.3	24.0	1.0
	08/05/04	08/12/04	0.8	0.2	20.5	0.9
	08/12/04	08/19/04	1.1	0.2	26.9	1.0
	08/19/04	08/26/04	0.7	0.2	17.8	0.8
	08/26/04	09/02/04	0.8	0.2	15.4	0.8
	09/02/04	09/09/04	1.1	0.2	21.2	0.9
	09/09/04	09/16/04	1.0	0.2	19.7	0.9
	09/16/04	09/23/04	0.6	0.2	16.3	0.8
	09/23/04	09/30/04	0.9	0.2	27.6	1.0

[1] Operated by Shoshone-Bannock Tribes.

Appendix B

Table B1. Weekly concentrations (in 1 x 10^{-3} pCi/m^3) for gross alpha and gross beta analyses for PM_{10} air samples for all locations, third quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Atomic City	07/01/04	07/08/04	1.2	0.5	30.0	1.9
	07/08/04	07/15/04	1.0	0.5	27.0	1.8
	07/15/04	07/22/04	1.1	0.4	29.0	1.5
	07/22/04	07/29/04	0.9	0.4	33.0	1.6
	07/29/04	08/05/04	1.6	0.4	44.8	1.8
	08/05/04	08/12/04	1.2	0.5	38.9	2.1
	08/12/04	08/19/04	1.3	0.4	52.5	2.0
	08/19/04	08/26/04	0.8	0.4	23.4	1.7
	08/26/04	09/02/04	0.7	0.4	21.9	1.3
	09/02/04	09/09/04	1.0	0.3	29.3	1.5
	09/09/04	09/16/04	1.1	0.4	29.3	1.5
	09/16/04	09/23/04	1.2	0.4	29.3	1.5
	09/23/04	09/30/04	0.8	0.5	43.2	2.2
Mud Lake	07/01/04	07/08/04	1.0	0.3	23.1	1.3
	07/08/04	07/15/04	0.6	0.3	24.7	1.4
	07/15/04	07/22/04	0.7	0.3	23.2	1.3
	07/22/04	07/29/04	1.0	0.4	27.9	1.5
	07/29/04	08/05/04	1.5	0.4	38.5	1.7
	08/05/04	08/12/04	0.6	0.4	30.0	1.5
	08/12/04	08/19/04	1.4	0.4	43.9	1.8
	08/19/04	08/26/04	1.3	0.4	19.7	1.3
	08/26/04	09/02/04	0.7	0.4	24.0	1.4
	09/02/04	09/09/04	1.1	0.4	27.2	1.8
	09/09/04	09/16/04	0.8	0.3	25.3	1.4
	09/16/04	09/23/04	1.6	0.6	25.7	1.8
	09/23/04	09/30/04	1.1	0.4	41.9	1.8

Appendix C

Table C-1. Results for additional electret locations, third quarter, 2004.

Sample Location	Net Corrected Exposure (uR/h)	± 2 SD (uR/h)
Dubois	16.8	1.9
Hamer	20.2	2.0
Sugar City	22.9	2.1
Blue Dome	16.8	1.9
TAN	19.9	2.0
ICPP I	20.2	2.0
NRF	17.3	1.9
EBR II	19.5	2.0
TRA	20.4	2.0
Grid 3	19.0	1.9
PBF	18.3	1.9
CFA	18.2	1.9
RWMC	19.5	2.0
Roberts	22.0	2.0
Kettle Butte	20.5	2.0
Blackfoot	16.3	1.9
Taber	20.7	2.0
Aberdeen	19.4	1.7
Minidoka	17.7	1.8
Arco	19.6	2.0
Richfield	21.2	1.9
EBR I	18.9	1.9
Reno Ranch	18.4	1.9
Rover Rd. 2.9mi	16.8	1.9
Rover Rd. 4.9mi	20.4	2.1
Rover Rd. 6.3mi	19.1	2.0
Rover Rd. 6.8mi	17.7	1.9
Rover Rd. 8.8mi	19.4	2.0
Rover Rd. 10.8mi	20.1	2.0
Rover Rd. 15.4mi	21.3	2.0
Rover Rd. 17.4mi	22.0	2.1
MP1 - 22/33	17.1	1.9
MP3 - 22/33	18.5	1.9
MP5 - 22/33	15.4	1.8
MP7 - 22/33	16.4	1.9
MP9 - 22/33	19.4	2.0
MP23 - 33	18.6	1.9
MP25 - 33	16.7	1.9

Table C-1 continued. Results for additional electret locations, third quarter, 2004.

Sample Location	Net Corrected Exposure (uR/h)	± 2 SD (uR/h)
MP27 - 33	23.6	2.1
MP29 - 33	16.2	1.9
MP31 - 33	22.0	2.1
MP33 - 33	19.9	2.0
MP35 - 33	20.0	2.0
MP37 - 33	17.6	1.9
MP39 - 33	18.6	1.9
MP41 - 33	20.9	2.0
MP43 - 33	24.0	2.1
Mud Lake - Bank of Commerce	25.5	2.7
MP1 - Lincoln Blvd	20.0	2.0
MP5 - Lincoln Blvd	21.9	2.0
MP7 - Lincoln Blvd	21.9	2.0
MP9 - Lincoln Blvd	20.2	2.4
MP11 - Lincoln Blvd	20.3	2.0
MP13 - Lincoln Blvd	19.5	2.0
MP15 - Lincoln Blvd	20.7	2.0
MP17 - Lincoln Blvd	20.9	2.0
MP19 - Lincoln Blvd	20.8	2.0
MP21 - Lincoln Blvd	19.4	2.0
MP264 - 20	19.8	2.0
MP266 - 20	17.5	1.9
MP268 - 20	19.7	2.0
MP270 - 20	19.1	1.9
MP272 - 20	17.4	1.9
MP274 - 20	17.2	1.9
MP276 - 20	18.5	1.9
MP270 - 20/26	22.5	2.1
MP268 - 20/26	16.6	1.9
MP266 - 20/26	18.1	1.9
MP263 - 20/26	20.6	2.0
MP261 - 20/26	21.7	2.0
MP259 - 20/26	18.1	2.3
Howe Fence-line 1.4mi	17.3	1.9
Howe Fence-line 2.3mi	17.3	1.9
Howe Fence-line 4.2mi	20.2	2.0
Howe Fence-line 6.5mi	21.5	2.0
Howe Fence-line 8.6mi	18.2	1.9
Howe Fence-line 9.7mi	17.0	1.9
Howe Met. Tower	20.7	2.0

Appendix D

Table D-1. List of volatile organic compounds (VOCs) analyzed for water verification samples, third quarter, 2004. Minimum detectable concentrations (MDC) are expressed in µg/L.

Analyte	MDC
Benzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
1,4-Dichlorobenzene	0.5
1,2-Dichlorobenzene	0.5
1,2-Dichloroethane	0.5
1,1-Dichloroethene	0.5
cis-1,2-Dichloroethene	0.5
trans-1,2-Dichloroethene	0.5
1,2-Dichloropropane	0.5
Ethylbenzene	0.5
Methylene Chloride	0.5
Styrene	0.5
Tetrachloroethylene (PERC)	0.5
Toluene	0.5
1,2,4-Trichlorobenzene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethylene	0.5
Vinyl chloride	0.5
Xylenes (total)	0.5
Bromodichloromethane	0.5
Dibromochloromethane	0.5
Bromoform	0.5
Chloroform	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromomethane	0.5
n-Butylbenzene	0.5
sec-Butylbenzene	0.5
tert-Butylbenzene	0.5
Chloroethane	0.5
Chloromethane	0.5
2-Chlorotoluene	0.5
4-Chlorotoluene	0.5
1,2-Dibromo-3-chloropropane (DBCP)	1.0
1,2-Dibromoethane (EDB)	0.5

Table D-1 continued. List of volatile organic compounds (VOCs) analyzed for water verification samples, third quarter, 2004. Minimum detectable concentrations (MDC) are expressed in µg/L.

Analyte	MDC
Dibromomethane	0.5
1,3-Dichlorobenzene	0.5
Dichlorodifluoromethane	0.5
1,1-Dichloroethane	0.5
1,3-Dichloropropane	0.5
2,2-Dichloropropane	0.5
1,1-Dichloropropene	0.5
cis-1,3-Dichloropropene	0.5
trans-1,3-Dichloropropene	0.5
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
p-Isopropyltoluene	0.5
Methyl Tert Butyl Ether (MTBE)	1.0
Naphthalene	1.0
n-Propylbenzene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,2,3-Trichlorobenzene	1.25
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	0.5
1,3,5-Trimethylbenzene	0.5